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OBSERVATIONS ON THE SPAWNING HABITS OF SOME OF THE JAPANESE OPISTHOBRANCHIA (II)¹⁾

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With Plates XXIV-XXVI and 3 Text-figures

5. *Goniodoris castanea* ALDER & HANCOCK

(Pl. XXIV, Figs. 1a-1b)

Reference to the species: BABA 1955, pp. 17-18, pl. 8, fig. 19, text-fig. 22.

Unlike those of *G. glabra*, the spawns here obtained from Seto and Kada, Kii Province, during May and June, are entirely colourless, and each consists of a long broad ribbon which is attached along its edge and wound in a loose spiral. The diameter of the whole spiral in surface view is about 10 mm. The capsules within the ribbon contain a single egg each.

6. *Glossodoris pallelescens* (BERGH)

(Text-fig. 1; Pl. XXIV, Fig. 2)

Reference to the species: BABA 1949, p. 50, pl. 17, fig. 60, text-fig. 53.

The spawning of this species appears to be most active from July to early August. In Toyama Bay and at Sado Island of the Japan Sea side, the full-grown animals come together during this period in enormous numbers, copulate, and lay eggs in rocky beds or in shaded caves below the water. Here the egg mass is distinct in being laid flat on the substratum. It consists of a long and ashy white ribbon, coiled tightly in about $2\frac{1}{4}$ convolutions. The whole mass measures from 12 to 15 mm in diameter in surface view. A single egg is contained within each capsule. Spawning has also been observed at Tannowa, Osaka Bay, in July.

1) Contributions from the Seto Marine Biological Laboratory, No. 278.

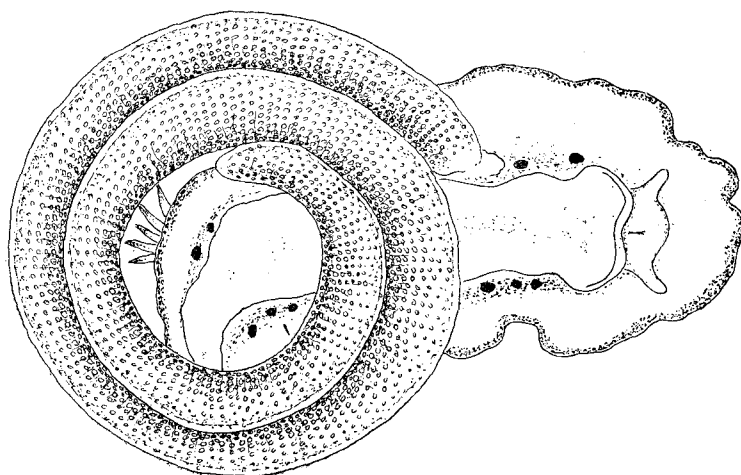


Fig. 1. *Glossodoris pallescens*.

A spawning animal from below (Kannonzaki, Toyama Bay, at 10 a. m., July 27, 1952). $\times 5$.

7. *Glossodoris festiva* (ADAMS)

(Text-fig. 2; Pl. XXIV, Figs. 3a-3c)

Reference to the species: BABA 1949, p. 51, pl. 18, fig. 63, text-fig. 56.

The spawning period of this species is from May to early August. Copulation

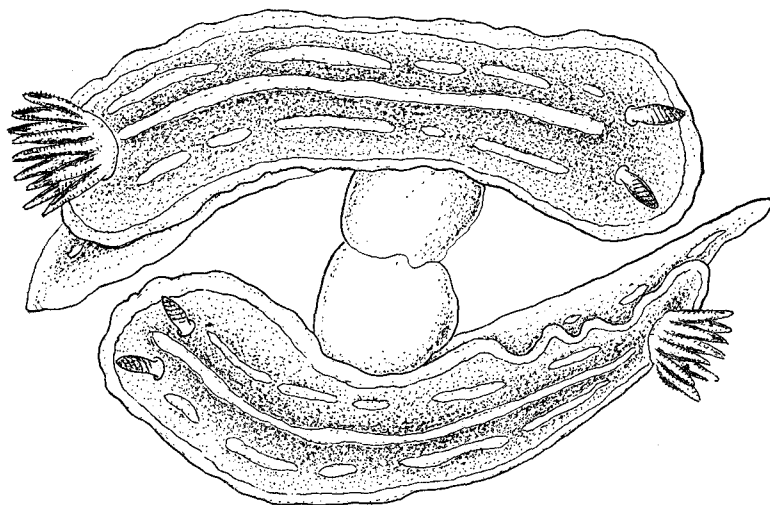


Fig. 2. *Glossodoris festiva*.

Pairing animals from above (Seto, at 2:30 p. m., June 10, 1952). $\times 2.5$.

was once observed at Seto in a tide pool under direct sunshine in June. In Toyama Bay this species was found congregate and spawning most actively late in July. The egg mass thus laid on the leaves of the sea-weeds or on rock is very much unlike that of *G. pallescens* in general appearance. The ribbon of the egg mass is in from 2 to $3\frac{1}{4}$ convolutions, and it is always found standing vertically along the edge. The whole egg mass is ashy white and 10-14 mm in diameter in surface view. As usual a single egg is contained within each of the capsules.

8. *Glossodoris sibogae* (BERGH)

(Pl. XXIV, Fig. 4)

Reference to the species: BABA 1949, p. 51, pl. 17, fig. 62, text-fig. 55.

During the early part of August the fully matured specimens of this species have commonly been found on the shores of Sado Island, particularly in such places as shaded caves below the water. The spawn obtained in the aquarium tank of the Sado Marine Biological Laboratory does not differ much in general shape and colouring from that of *G. festiva*. It is coiled in about $1\frac{1}{2}$ convolutions. The diameter of the whole egg mass in surface view measures about 12 mm. The majority of the capsules as usual contain a single egg each.

9. *Glossodoris aureopurpurea* (COLLINGWOOD)

(Pl. XXIV, Fig. 5)

References to the species: BABA 1949, p. 50, pl. 17, fig. 61, text-fig. 54; ABE & BABA 1952, pp. 262, 265, figs. 6, 9.

A spawn of this species has been taken in Toyama Bay during the last part of July. It is formed of a long and narrow ribbon, fastened to the substratum by the inner edge, and the whole mass is in a loosely wound spiral of $3\frac{1}{2}$ convolutions. The ribbon is as usual ashy white in colour.

10. *Aldisa sanguinea* (COOPER)

(Pl. XXIV, Fig. 6)

Reference to the species: BABA 1949, pp. 62-63, pl. 24, fig. 86, text-fig. 75.

Specimens of this species, deep orange yellow and kept alive in the Sugashima Marine Biological Laboratory, have laid eggs during the last half of April. The egg masses thus in hand are all of a vivid orange yellow, and take the form of a spiral coil of from 2 to 4 convolutions. The whole egg mass is 8-13 mm in diameter in surface view. A single egg is contained in each capsule.

11. *Homoiodoris japonica* BERGH

(Pl. XXIV, Figs. 7a-7b)

Reference to the species: BABA 1949, p. 66, pl. 25, figs. 91-92, text-fig. 81.

Usually associated with the orange-coloured sponge, *Reniera japonica*, this form represents one of the commonest dorids in our territory. The breeding season is from March to July, and during this period (especially during the months from April to June) the egg masses in pink or in chrome yellow are to be found in large quantities everywhere on shores in different situations, viz. in rock crevices, and on rock surface sheltered by brown algae, etc. The egg masses themselves are each in the form of a long broad ribbon which in its turn is coiled in from $1\frac{1}{2}$ to 2 convolutions. The whole egg masses thus in spiral coil measure more or less than 6 cm in diameter in surface view. The capsules within the ribbon contain usually from 3-6 eggs in each.

12. *Argus speciosus* ABRAHAM

(Pl. XXIV, Figs. 8a-8b)

Reference to the species: BABA 1949, pp. 67-68, pl. 26, fig. 96.

Specimens of this species are also common, or even abundant on shores around the Seto Marine Biological Laboratory. The spawning season studied by us there is from May to early July. As usual the egg masses are found among rocks, but they have a series of distinctions which make the recognition of the species very easy. (1) These egg masses are strikingly large and voluminous, the diameter of the individual masses in surface view being 7-8 cm. They are remarkably tinged with orange yellow. (2) The egg masses are each in the form of a long broad ribbon and the whole length of it is complicated by thick foldings. (3) As many as 7-30 eggs are contained within each of the capsules.

13. *Dendrodoris (Dendrodoris) gemmacea*

(ALDER & HANCOCK)

(Pl. XXIV, Fig. 9)

Reference to the species: BABA 1949, pp. 69-70, pl. 27, figs. 100-101.

The spawning of this species has been observed at Seto in May and early in June. The egg mass is of an ashy white colour, contains $2\frac{1}{2}$ convolutions, and forms a disk about 6 cm in diameter. The majority of the capsules contain a single egg. Sometimes there are 2-3 eggs packed within one capsule.

14. *Dendrodoris (Doriopsilla) miniata*

(ALDER & HANCOCK)

(Pl. XXIV, Fig. 10)

Reference to the species: BABA 1949, p. 71, pl. 28, figs. 105-106.

The spawning of this species has been recognized at Seto during May in the field and in the aquarium. The egg mass is small (about 17 mm in diameter of the whole mass), and of a deep chrome-yellow colour. It is coiled in about 1½ convolutions. From 1 to 2 eggs are contained in each capsule.

15. *Dermatobranchus (Dermatobranchus) striatus*

(VAN HASSELT)

(Pl. XXV, Figs. 1a-1b)

Reference to the species: BABA 1949, p. 73, pl. 29, fig. 109, text-fig. 83.

The specimens of this species have been found spawning in the aquarium of the Sugashima Marine Biological Laboratory and at Abugashima Island in Toyama Bay during the month of July. The parent animals measured about 20 mm in length. The egg mass is here in the form of a short, flat, whitish or pinkish white ribbon which is fastened flat to the substratum in a shallow curve. The length of the ribbon is about 6-8 mm. Only 1 egg is contained in each capsule.

16. *Dermatobranchus (Dermatobranchus)**striatellus* BABA

(Pl. XXV, Fig. 2)

Reference to the species: BABA 1949, pp. 74-75, pl. 30, fig. 110, text-figs. 85-86.

The spawns obtained at Seto in the aquarium in June were very much unlike those in *D. striatus*. Actually they take the form of a small glass cup with a short stalk by which the whole mass is fastened to the other object. The diameter of the cup in surface view varies from 2.3 to 3 mm. The capsules are not thickly set in the egg mass. The eggs are large relative to the size of the egg mass, and slightly tinged with yellow. As before, a single egg is enclosed within each of the capsule.

17. *Melibe vexillifera* BERGH

(Pl. XXV, Figs. 3a-3b)

Reference to the species: BABA 1949, p. 93, pl. 38, fig. 136.

The breeding season of this species is from March to August. At Yuzaki in the neighbourhood of the Seto Marine Biological Laboratory, especially abundant masses of eggs are to be found almost every year among the rocks in tidal days of May and June. These egg masses are shaped roughly as in *M. leonina* (see O'DONOGHUE 1922, pp. 134-135, pl. 4, fig. 9), and measure about 25-40 mm in total size. Each of the egg masses is in the form of a long, broad, orange red to orange yellow ribbon, and is fastened to the leaves of the seaweeds or directly to the rock surface in a much twisted manner. The majority of the capsules contain 1-3 eggs in each.

18. *Cratena ornata* BABA

(Text-fig. 3A; Pl. XXV, Fig. 4)

Reference to the species: BABA 1955, pp. 27-28, pl. 14, figs. 38-39, text-figs. 42-43.

The spawning of this species has taken place in Osaka Bay and its vicinity in February, March and in June. The eggs, slightly yellowish white in colour, are laid in a sinistral coil of about 3-4 turns with a total diameter of 7-10 mm in surface view of the coil. Only 1 egg is contained in each capsule.

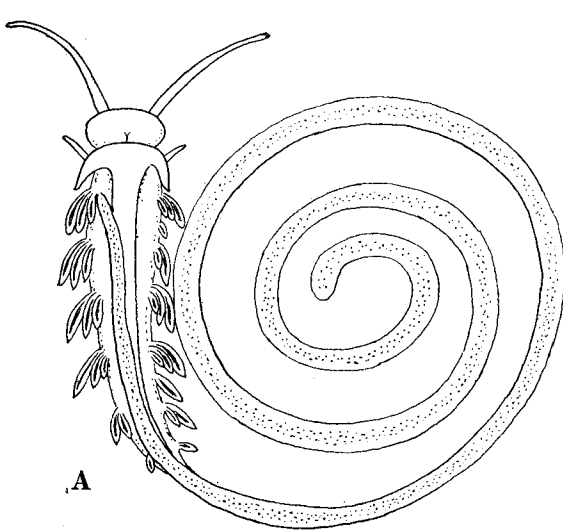


Fig. 3A. *Cratena ornata*.

A spawning animal from below (Tannowa, Osaka Bay, at 2:30 p. m., Mar. 18, 1951). ×6.

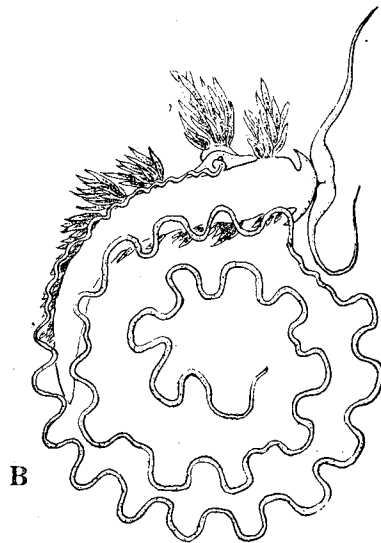


Fig. 3B. *Hervia ceylonica*.

A spawning animal from below (Tannowa, Osaka Bay, at 3 p. m., Mar. 30, 1951). ×2.

19. *Favorinus japonicus* BABA

(Pl. XXV, Figs. 5a-5b)

Reference to the species: BABA 1949, pp. 101-102, pl. 43, fig. 150, text-figs. 133-134.

Spawning in this species has taken place at Seto in June. The egg mass consists of a slender, opaque white string which is sinistrally coiled to form a circular patch measuring about 4 mm in diameter. The egg capsules are in double rows in the string. They contain a single egg each.

20. *Hervia ceylonica* FARRAN

(Text-fig. 3B; Pl. XXV, Figs. 6a-6b)

References to the species: BABA 1949, p. 104, text-figs. 138-139; BABA 1955, p. 34, pl. 20, figs. 54-56.

Specimens of this species sometimes come together in considerable numbers among rocks or upon sea-weeds, and lay eggs underneath stones during the months from March to July (most actively from March to May). They also spawn easily in captivity. The egg masses thus laid are slightly pinkish yellow, and form perfectly circular patches of about 25-27 mm in diameter. These are composed of a narrow cylindrical string coiled sinistrally like a spiral spring, and the entire string in its turn is thrown into a series of minute loops. The eggs are each protected by a capsule.

The spawns of *H. emurai* BABA, obtained by Mr. Y. HONMA from the pool in front of the Sado Marine Biological Laboratory in May, 1954, are much like those of *H. ceylonica* in general appearance.

21. *Hervia lineata* ELIOT

(Pl. XXV, Fig. 7)

Reference to the species: BABA 1949, pp. 103-104, pl. 44, figs. 152-153, text-fig. 137.

This species is found spawning in August at Wagu, Shima Province, and at Abugashima Island, Toyama Bay. The egg masses thus obtained are whitish, 3-4 mm in diameter across the masses, and consist of a narrow string which does not form complicated loops as seen in *H. ceylonica*. A single egg is contained as usual within each capsule.

22. *Aeolidiella japonica* ELIOT

(Pl. XXV, Figs. 8a-8c)

Reference to the species: BABA 1949, p. 111, pl. 49, fig. 166, text-fig. 153.

A large specimen of this species, kept alive in water, has spawned twice at Seto late in June. The egg-strings are yellowish white, and are elaborately thrown into a series of triangular loops. From 2 to 4 eggs are contained in each of the capsules.

23. *Hydatina physis* (LINNÉ)

(Pl. XXVI, Figs. 1a-1c)

The animals of this beautiful species are fairly common on shores at Seto. They become mature, copulate head to tail, and lay eggs most actively during the months of May and June. The egg masses thus laid on sandy beach and somewhat deeply inserted within it, are in the form of long, broad, ashy white ribbons, each of which in its turn is collected together in a much twisted manner. The majority of the capsules within the egg masses are packed with 7-16 eggs. The whole egg masses are about 25×40 mm in size.

24. *Aplysia* species and their allies

(Pl. XXVI, Fig. 2)

The youngest specimens of *Aplysia kurodai* (BABA) usually come ashore very early in winter. They gradually get larger, copulate in chains and lay the most abundant egg masses during the months from April to June (the actual breeding season of this species being from March to July). The egg masses in this species are from pink to yellow, and the egg-strings which form the masses are about 1 mm in thickness. A large number of eggs (15-30 or more) are crowded together within each of the capsules.

Almost everywhere on shores the voluminous egg masses of *A. sibogae* BERGH are seen usually mixed with those of *kurodai*.

A. parvula MÖRCH is a small-sized species which lays eggs comparatively in small masses. These latter are pink or yellow, and are formed of fine strings measuring about 0.5 mm in thickness. Only a few (2-3) eggs are contained in each of the capsules. At Seto and Sugashima of the Pacific Ocean side, this species spawns most actively from March to May, and in Toyama Bay of the Japan Sea side it is found laying until as late as the end of July.

The egg masses of *A. hirasei* (BABA) are roughly as large as those of *parvula*, but the former are easily recognized in the field by their peculiar colouring of yellowish

green. There are 2-3 eggs within each of the capsules. At Seto the spawns of this species are to be found most commonly from March to June.

The species, *Notarchus (Bursatella) leachii leachi* BLAINVILLE, var. *freeri* (GRIFFIN), has been found spawning in the field in November at Kada, and in aquarium in May at Seto (see also GRIFFIN 1912, p. 66). The egg-strings are approximately as large as those of *A. kurodai*, about 1 mm thick, faintly green when fresh, and the capsules within the strings are packed with 15-25 eggs.

25. *Pleurobranchaea novaezealandiae* CHEESEMAN

(Pl. XXVI, Figs. 3a-3c)

Reference to the species: BABA 1949, p. 38, pl. 10, fig. 34, text-figs. 31-32.

This species comes ashore very early in winter. It occurs most abundantly in the waters round Seto and some other stations, and spawns among rocks during the periods from early March to the last part of June. The egg masses are deposited in the form of long, cylindrical, ashy white tubes (see TCHANG 1936, pl. 3, fig. 11, pl. 13, figs. 1-2), apparently hollowed in the centre. The tubes themselves are in loose loops, attached along their edges, and measure from 8 to 40 cm long and about 5-10 mm thick. Within the tubes the strings of capsules are arranged round the hollowed spaces, so as to assume an indistinct, striated appearance of the whole length of the tubes. From 1 to 4 of the eggs are enclosed within one capsule.

26. *Elysia (Elysia) marginata* (PEASE)

(Pl. XXVI, Figs. 4a-4b)

Two small specimens, referable to the above species, were collected from Seto in August, 1952. The spawn obtained at that time in the aquarium is formed of a narrow string wound loosely in a spiral coil of about 6 mm in diameter in surface view. It is entirely opaque white. A single egg is within each capsule.

E. (E.) abei BABA (see BABA 1949, pl. 8, fig. 26 and BABA 1955, p. 11, text-fig. 10) is to be found abundantly on various sea-weeds growing round the Abugashima Island in Toyama Bay. The spawn of this species, laid down in captivity late in July, has assumed the same general appearance as that of *marginata*.

27. *Elysia (Elysia) atroviridis* BABA

(Pl. XXVI, Fig. 5)

Reference to the species: BABA 1955, p. 12, text-figs. 11-12.

Abundant specimens of this *Elysia* have been found attacking on *Codium contractum* in May at Sugashima. They have continued spawning in captivity during

May and June. The spawns are opaque white, 2-3 mm across the spiral coil, and a little more tightly wound than in *marginata* and in *abei*.

28. *Elysia* (*Elysia*) *halimeda* MACNAE

(Pl. XXVI, Fig. 6)

Reference to the species: MACNAE 1954, pp. 57-59, pl. 3, fig. 2, text-fig. 2.

A handsome specimen, possibly to be referred to the above species from South Africa, was found associated with *Halimeda cuneata* growing among rocks at Wagu, Shima Province, in the early part of August, 1951. The spawn of this captured animal is seen to be formed of a long but somewhat broad and flattened band in more or less tight spiral. It is faintly tinged with yellow.

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EXPLANATION OF PLATES XXIV-XXVI

PLATE XXIV

Figs. 1a-1b. *Goniodoris castanea*.

1a. A complete egg-ribbon from side (Seto, May 10, 1952).
×4.5.

1b. An egg-capsule. ×110.

Fig. 2. *Glossodoris pallescens*. An egg-capsule. ×130.

Figs. 3a-3c. *Glossodoris festiva*.

3a. A complete egg mass from side (Seto, May 13, 1952). ×4.

3b. Another egg mass from side (Abugashima, Toyama Bay,
July 23, 1952). ×3.

3c. An egg-capsule. ×130.

Fig. 4. *Glossodoris sibogae*. A complete egg mass from side (Sado,
Aug. 4, 1954). ×3.

Fig. 5. *Glossodoris aureopurpurea*. A complete egg mass from above
(Abugashima, Toyama Bay, July 24, 1951). ×5.

Fig. 6. *Aldisa sanguinea*. A complete egg mass from above (Suga-
shima, Apr. 18, 1954). ×4.

Figs. 7a-7b. *Homoiodoris japonica*.

7a. A complete egg mass from above (Sugashima, May 7, 1951).
×2/3.

7b. An egg-capsule with 3 eggs. ×90.

Figs. 8a-8b. *Argus speciosus*.

8a. A part of the thickly folded egg-ribbon. ×4/5.

8b. An egg-capsule with 10 eggs. ×50.

Fig. 9. *Dendrodoris gemmacea*. A complete egg mass from above
(Seto, May 11, 1952). ×2/3.

Fig. 10. *Dendrodoris miniata*. A complete egg mass from above
(Seto, May 10, 1952). ×3.5.

PLATE XXV

Figs. 1a-1b. *Dermatobranchus striatus*.

1a. A complete egg mass from above (Sugashima, July 7, 1952).
×8.

1b. An egg-capsule. ×100.

Fig. 2. *Dermatobranchus striatellus*. A cup-shaped egg mass from
side (Seto, Apr. 18, 1952). ×20.

Figs. 3a-3b. *Melibe vexillifera*.

- 3a. A much twisted egg mass from above (Seto, June 9, 1952).
×1.5.
- 3b. An egg-capsule with 3 eggs. ×40.
- Fig. 4. *Cratena ornata*. A part of egg-string. ×15.
- Figs. 5a-5b. *Favorinus japonicus*.
- 5a. A complete egg mass from below (Seto, June 22, 1951).
×14.
- 5b. A part of egg-string. ×30.
- Figs. 6a-6b. *Hervia ceylonica*.
- 6a. A complete egg mass from below (Tannowa, Osaka Bay,
Mar. 30, 1951). ×1.6.
- 6b. A part of egg-string. ×15.
- Fig. 7. *Hervia lineata*. A complete egg mass from below (Wagu,
Shima Province, Aug. 4, 1951). ×15.
- Figs. 8a-8c. *Aeolidiella japonica*.
- 8a. A somewhat incomplete egg mass (Seto, June 22, 1951).
×1.5.
- 8b. A part of egg-string. ×15.
- 8c. An egg-capsule with 4 eggs. ×170.

PLATE XXVI

- Figs. 1a-1c. *Hydatina physis*.
- 1a. Pairing animals from above (Seto, at 10:30 a. m., June 8,
1952). ×1.5.
- 1b. A complete egg mass from side (Seto, June 8, 1952). ×1.
- 1c. An egg-capsule with 9 eggs. ×70.
- Fig. 2. *Aplysia kurodai*. Cross section of an egg-string (Seto, May
13, 1952). ×30.
- Figs. 3a-3c. *Pleurobranchaea novaezealandiae*.
- 3a. A complete egg mass from above (Seto, Apr. 1, 1953).
×1/2.
- 3b. A part of egg mass from side. ×2.5.
- 3c. An egg-capsule with 4 eggs. ×60.
- Figs. 4a-4b. *Elysia marginata*.
- 4a. A complete egg mass from above (Seto, Aug. 9, 1952). ×8.
- 4b. An egg-capsule. ×70.
- Fig. 5. *Elysia atroviridis*. A complete egg mass from below (?)
(Sugashima, June 4, 1951). ×20.
- Fig. 6. *Elysia halimeda*. A complete egg mass from above (Wagu,
Shima Province, Aug. 4, 1951). ×8.

